

VIRTUAL FLY LAB MODEL SOLUTION

Introduction

The purpose of this virtual fly lab is to determine the type of inheritance pattern of the mutant. Inheritance patterns can be autosomal dominant or recessive or sex-linked dominant or recessive. We need to observe the offspring phenotype ratios to determine the type of inheritance.

PROBLEM #1

A wild-type female fly crossed with a dumpy-winged male.

F1 Generation:

Cross- (Female: +) X (Male: DP)

Phenotype	Number of Flies	Proportion of Total
Male: Wild Type	581	0.5052
Female: Wild Type	575	0.4948
Total	1162	

Sex ignored:

Phenotype	Number of Flies	Proportion of Total
Wild Type	1162	1.0000
Total	1162	

Let D represent the wild type allele.

Let d represent the dumpy wing allele.

There are two possible Punnett squares to show a cross between a wild type female fly and a dumpy winged male.

♀ ~~Dd x dd~~ ♂

OR

♀ DD x dd ♂

	D	d
d	Dd	dd

	D
d	Dd

In the results, 581 wild type male and 575 wild type female flies were produced. None of the offspring were dumpy-winged, all the offspring produced were wild type. Thus, the female fly cannot be Dd, because then it would be expected that both wild type and dumpy-winged offspring could be produced. Therefore the wild-type female fly's genotype is DD which will produce only wild type offspring when mated with a dumpy-winged male. In this case, all the offspring produced were wild type and the Punnett Square on the right shows that there is a 100% chance of getting wild type offspring because the female gave the dominant allele to each offspring.

F2 Generation:

Cross- (Female: +) X (Male: +)

Phenotype	Number of Flies	Proportion of Total
Female: Wild Type	461	0.3691
Male: Wild Type	458	0.3667
Female: Dumpy wings	165	0.1321
Male: Dumpy wings	165	0.1321
Total	1249	

Sex ignored:

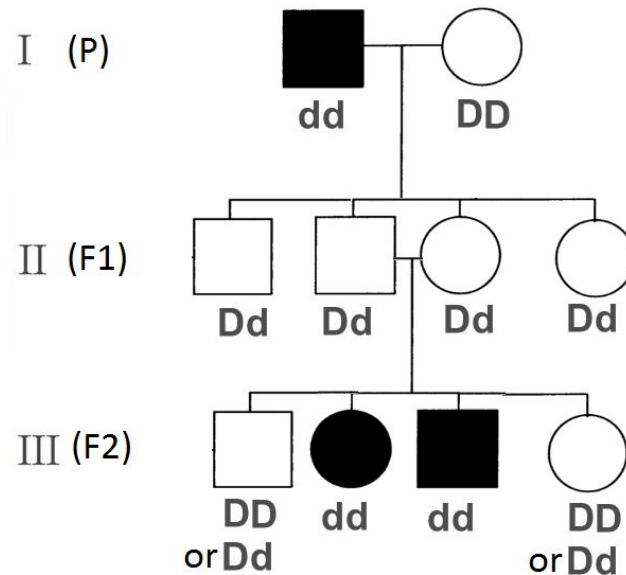
Phenotype	Number of Flies	Proportion of Total
Wild Type	919	0.7358
Dumpy wings	330	0.2642
Total	1249	

The cross between the two F1 flies to produce the F2 generation is:

Dd X Dd

	D	d
D	DD	Dd
d	Dd	dd

The cross between a wild type male and female F1 flies produced both wild type and dumpy-winged offspring. There were 919 wild type flies and 330 dumpy-winged flies produced from the cross. From crossing a wild type male and female there is 75% chance of producing wild type offspring and 25% chance of producing dumpy-winged offspring. Ignoring sex, the data show a phenotype ratio of wild type: dumpy wings = 919:330 \approx 3:1.



Conclusion

The data seems to follow a classic Mendelian pattern, strongly suggesting that the inheritance pattern of the dumpy-winged trait is **autosomal recessive**. It is autosomal because the affected number of females and males is equal, indicating no sex-linked pattern. It is recessive because the trait does skip generations and two unaffected parents have affected offspring, indicating that two heterozygous parents produced homozygous recessive dumpy-winged offspring.

Reciprocal Cross Wild type male crossed with dumpy-winged female.

Hypothesis: The results would be the same if the P generation had been a male wild-type crossed with a dumpy-winged female. The gene for the trait is on an autosomal chromosome and not the sex chromosome. Therefore the sex of the parents does not matter and the results of a reciprocal cross would be the same as the original parental cross.

F1 Generation:

Cross- (Female: DP) X (Male: +)

Phenotype	Number of Flies	Proportion of Total
Male: Wild Type	585	0.5078
Female: Wild Type	567	0.4922
Total	1152	

Sex ignored:

Phenotype	Number of Flies	Proportion of Total
Wild Type	1152	1.0000
Total	1152	

♂ DD X dd ♀

	d	d
D	Dd	Dd
D	Dd	Dd

A wild type male fly with the genotype DD is crossed with a dumpy winged female fly with the genotype dd. All the offspring are wild type flies as shown in the Punnett square. The results for the F1 generation were all wild type. From the male the dominant trait was passed to the offspring. There were 585 wild type male and 567 wild type female produced from the cross. From the mating of a wild type male and dumpy winged female there is a 100% chance of producing wild type offspring.

F2 Generation:

Cross- (Female :+) X (Male :+)

Phenotype	Number of Flies	Proportion of Total
Male: Wild Type	472	0.3758
Female: Wild Type	454	0.3615
Female: Dumpy wings	168	0.1338
Male: Dumpy wings	162	0.1290
Total	1256	

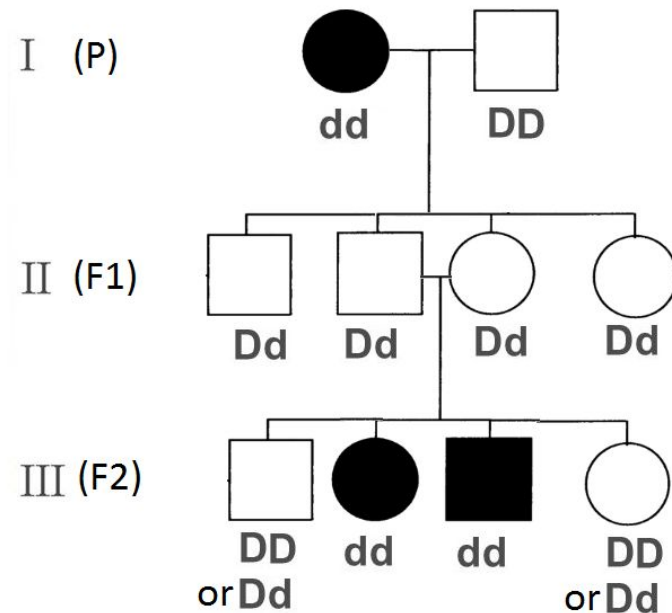
Sex ignored:

Phenotype	Number of Flies	Proportion of Total
Wild Type	926	0.7373
Dumpy wings	330	0.2627
Total	1256	

Dd x Dd

	D	d
D	DD	Dd
d	Dd	dd

From the cross between a wild type male (Dd) and female (Dd) from the F1 generation, both wild type and dumpy-winged offspring were produced. The Punnett square also shows the ratio of producing offspring. Ignoring sex, the data show a ratio of wild type to dominant = 926: 330 \approx 3:1.



Conclusion

The hypothesis was supported by the results, which were the same for the reciprocal cross and the original P generation. They both resulted in being **autosomal recessive** because both unaffected parents of an affected individual are heterozygous and the numbers of affected males and females are equal.